

# PARTNERS IN DATA MANAGEMENT: CREATING A NATIONAL CHANNEL FRAMEWORK DATABASE by THE NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION AND THE US ARMY CORPS OF ENGINEERS

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## Abstract

The United States Army Corps of Engineers (USACE) and the National Oceanic and Atmospheric Administration (NOAA) work closely together to provide navigation information to the maritime community. NOAA is responsible for charting the territorial waters of the United States including navigation channels used by transiting vessels into and out of United States ports. These navigation channels are portrayed and described on NOAA products including the NOAA Electronic Navigation Chart (NOAA ENC®). The NOAA ENC® is a vector-based digital file containing marine features suitable for marine navigation. The USACE is responsible to maintain the navigation channels and to provide accurate channel data to NOAA. The USACE channel data consist of hydrographic survey information and channel framework. Channel framework contains the outside channel limits and the inside configuration of the navigation channel. USACE channel data supplies essential information to the mariner and, therefore, comprise a fundamental component of the NOAA ENC®. NOAA and USACE are working closely to communicate issues concerning USACE hydrographic survey work and channel framework data. This continuing effort provides improved navigation products for the mariner.

## USACE/NOAA Partnership

NOAA meets the responsibility to chart the territorial waters of the United States by producing traditional paper navigation charts, Raster Navigation Charts (RNC) and the NOAA ENC®. USACE maintained channels and their associated data are integrated among all NOAA nautical products. The USACE provides NOAA with data for these channels, including channel framework and hydrographic conditions. Historically, NOAA and USACE have worked closely to provide the mariner with accurate channel navigation data. This partnership has been strengthened with the assignment of dedicated points of contact within both agencies. These contacts include key personnel at the USACE Topographic Engineering Center (TEC) Spatial Data Branch (SDB) and at individual USACE districts leading to improved communication and channel data delivery.

## What USACE provides NOAA

Results of USACE hydrographic surveys of maintained channels are regularly provided to NOAA as directed in 33 CFR 209.325. These surveys are furnished on survey sheets (drawings) and/or channel condition reports. Hydrographic survey sheets depict channel limits and the hydrography within the maintained channel. USACE provides NOAA different categories of hydrographic surveys. These categories include condition and post dredge hydrographic surveys. A condition survey depicts hydrography prior to dredging operations; a post dredge survey shows post-dredging conditions.

Channel conditions are also reported to NOAA on USACE ENG Form 4021-R. These tabulated reports, known as a channel condition report, contain the channel's reach names and project dimensions. Channels are divided into separate

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sections called reaches. Reaches have specific project dimensions including depth, width and length. Reaches are further divided into quarters. A reach may be divided into four equal quarters or a mid width and two outside quarters depending upon the width of the channel. Controlling depths and their respective survey dates are listed for the separate quarters of each reach. The controlling depths are shoal biased and determined by USACE for each quarter. When necessary, a channel condition report also provides positional information for extreme shoaling or channel obstructions.

In addition to receiving data about channel conditions, USACE also provides NOAA with channel framework. As stated earlier, channel framework defines the outside limits of the maintained navigation channel as well as the inside configuration. The inside configuration refers to the reach locations and the channel quarters.

#### NOAA Analysis and Portrayal of USACE data

NOAA portrays critical channel information based on the data received from the USACE. Information is deemed critical if it is a danger to the mariner or reflects a significant change to what is already charted. Depending on the USACE reporting district, hydrographic survey sheets and channel condition reports are received in both analog and digital formats. Once the data is received NOAA reviews, categorizes and determines what products are affected. The data is then entered into a database that NOAA cartographers access. NOAA cartographers analyze and apply the data to the appropriate navigation products.

USACE survey data is portrayed on NOAA products in several different ways. On the traditional paper chart and the RNC, USACE survey data is portrayed as a legend, depth note or channel tabulation. On the NOAA ENC®, survey data is portrayed in depth areas. A depth area is a polygon feature and represents an individual channel quarter, or an entire channel depending on the channel width. Each depth area is attributed with a controlling depth and the date and source of the survey from which it originated. On the NOAA RNC, channel legends and notes contain a controlling depth and survey date from which the controlling depth was taken. (i.e. 9 FT July 2007). Channel tabulations are tables that list the channel names, the reaches in that channel, the quarters for the channel reaches, controlling depths for each quarter, survey dates and channel dimensions.

NOAA is capable of ingesting the various digital formats of channel information provided by USACE. NOAA has built data conversion into its production system that allows the cartographer to translate the digital data into a format that can be used in the current production system. Analog data is analyzed manually and scanned for digital import into the production system. The availability of digital USACE survey data offers the opportunity to streamline data processing and better meet production goals.

#### *Digital data issues*

USACE and NOAA recognize that standardizing the format of the data exchanged between the agencies including metadata and a standard delivery system is key to disseminating timely navigation data. Currently, NOAA receives digital data from USACE in Microstation DGN, AUTOCAD DWG and ASCII text file format. Understanding what the digital data represents and how the data was gathered and processed by the USACE is of critical importance, as sounding density and data filtering methods are not standard among the USACE reporting districts. Currently the metadata delivered to NOAA is limited however, both agencies recognize the importance of providing an agreed upon comprehensive set of metadata starting in the near future.

In the future, NOAA's current cartographic production will transition to a database driven production system. NOAA and USACE are in the process of base lining the channel information prior to importing the data into the new production system. The new system will maintain and produce all NOAA nautical product lines. Recent discussions between NOAA and USACE are exploring the goal of USACE providing NOAA with S-57 format or ESRI .shp files for all channel data.

A standardized delivery method for all USACE channel data is important. At this time, USACE delivers data to NOAA by several different methods. Some USACE districts post channel data on their websites and others mail the data to NOAA. Having one delivery method would alleviate processing time and avoid interruptions to data flow. NOAA and USACE are working together closely on this issue.

## NOAA ENC® Product

The NOAA ENC® is a major component of its charting program. The NOAA ENC® is a vector-based digital file containing marine features suitable for marine navigation. It is based on the International Hydrographic Organization (IHO) S-57 standard. The NOAA ENC® is intended for use in electronic charting systems (ECS) as well as Electronic Chart Display and Information Systems (ECDIS). The NOAA ENC® can also be used in geographic information systems (GIS) as base map data. The NOAA ENC® supports safe navigation and coastal management with their portrayal of topographic and hydrographic data. Originally to accelerate the production of the NOAA ENC®, much of the data was compiled from the raster chart product. Given the inherent positional error that this procedure may have introduced into the NOAA ENC® product NOAA is involved in an ongoing effort to baseline the data portrayed on the NOAA ENC®. This will better serve the NOAA ENC® users who are utilizing increasingly more accurate positioning tools. A major component of this baselining effort is the accurate portrayal of the United States Army Corps of Engineers (USACE) maintained navigation channels.

## Creating a National Channel Framework Database

NOAA has established a channel framework database of all USACE maintained navigation channels. This database contains records for the outside channel limits, channel reach positions and inside channel quarters. The requirement for this work was the increasing volume of digital channel data received from the USACE coupled with the substantial NOAA cartographic resource effort to analyze, compile and review this important data. NOAA sees the channel framework database as a tool that can aid in the processing of digital USACE channel data.

The channel framework database is populated with channel data from the NOAA ENC® cells which originated from the channel limits portrayed on USACE hydrographic survey sheets or digitized from NOAA paper navigation charts. The channel data is translated and stored in a shapefile format and can be extracted in a shapefile or design file format for chart comparison and compilation.

To validate the channel limit records in the framework database, NOAA initiated a baselining project. NOAA's baselining project coincides with the USACE channel framework project. A list of priority channels was established by NOAA, based on port significance, and USACE channel framework data was requested. In addition to the priority channels, requests for additional channel frameworks have surfaced in the course of cartographic application of USACE survey data. NOAA receives the channel frameworks from the USACE SDB. Once received, the framework is applied to the NOAA ENC® and raster product lines and the channel framework database is updated from the new cell.

The updated channel limits are made available through NOAA's critical correction website and US Coast Guard Local Notice to Mariners. Discrepancies are resolved with the assistance of the USACE districts as well as USACE SDB.

Consistent inter-agency quartering of the channels is a key aspect of the baselining project. Agreement on channel quartering is important because USACE channel condition reports contain controlling depths based on quarters and NOAA portrays quartering on its NOAA ENC® product. In addition NOAA cartographers use quartering to determine controlling depths. There are cases in which NOAA cartographers have to determine channel quartering when it is not provided by USACE. Discrepancies between NOAA and USACE quartering can result. Mariners also use USACE hydrographic survey data in conjunction with NOAA navigation products and any discrepancy could cause confusion.

Currently there are no set standards for quartering channels that are applicable to all situations. The difficulty in quartering arises in channels that have unusual or complicated geometry. USACE has the local knowledge and is best qualified to work with the navigational community to establish the channel quartering for channels with complex geometry. The USACE is currently working on quartering methodologies. NOAA has made the quartering in its channel framework database available to USACE to aid in establishing quartering and bringing both agencies into agreement. Once established by the USACE, the quartering framework will be made available to NOAA for database update and nautical product portrayal.

Throughout the baselining project, minor discrepancies have been noted and corrected. Occasionally, significant differences must be resolved. Working closely with USACE SDB and individual USACE districts, a resolution is

reached that mutually benefits both agencies and the mariner. The baselining project has helped to clear long standing errors of channel data presentation.

The channel framework baselining project is nation wide. There are approximately 600 individual navigation channels to be baselined. As stated earlier the channels are being prioritized based on tonnage and as conflicts arise. The ultimate goal is to have every channel baselined. Since the start of the project in 2003 NOAA and USACE have baselined 94 channel frameworks. Included in these 94 channel frameworks are 13 of the 40 major ports (based on tonnage). The pace of the baselining project is increasing from year to year. As decisions are made concerning quartering and data delivery formats this will lead to a significant increase in the availability of channel framework data from the USACE.

## Conclusion

USACE and NOAA continue to work productively to contribute to and provide critical navigation information for the maritime community. The establishment of a validated National Channel Framework is a shared priority. Both agencies are committed to the goal of data format and delivery standardization and the success and final implementation of a National Channel Framework.